

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding, made and entered into on this first day of August, 1994, by and between

Civilian Volunteer Auxiliary of the USAF
Civil Air Patrol
Maxwell Air Force Base, AL 36113

(hereinafter "CAP"); and ARNAV Systems, Inc., with offices at 16929 Meridian East, Puyallup, Washington, United States of America (hereinafter "ARNAV"); and CAP and ARNAV being individually referred to as "PARTY" and jointly referred to as the "PARTIES".

WITNESSETH:

WHEREAS, CAP is an established entity whose mission is safety of flight, search and rescue, and flight support of other government agencies; and

WHEREAS, ARNAV is an established company engaged in the manufacture of aircraft flight following systems, datalink systems, and product support services for aircraft flight following systems; and

WHEREAS, the PARTIES have made investments in the development of infrastructure to support their respective missions;

WHEREAS, the PARTIES, after considering their own unique and complementary backgrounds and capabilities in various elements, intend to demonstrate a datalink concept, WxLink, that will enhance General Aviation safety and provide flight following for CAP missions, investigate the feasibility of a cooperative effort in obtaining a national network of datalink communication;

NOW, THEREFORE, in consideration of the mutual covenants hereinafter set forth, CAP and ARNAV hereby agree as follows:

1. PURPOSE OF THE MOU

The purpose of the Memorandum of Understanding (MOU) is to set forth the basis for discussions and cooperation between the PARTIES involving the

evaluation of each other's technical capabilities, and to discover possible relationships regarding safety of flight issues that can be addressed through digital data communications made possible by WxLink.

Background:

WxLink is a two way datalink that up-links weather products to the aircraft, and down-links automatic pilot reports (PIREPS) of weather conditions aloft from the aircraft. These PIREPS are subsequently retransmitted via satellite back into the National Weather System for further dissemination to other weather users.

The current system of accepting and transmitting pilot reports (PIREPS) leave much to be desired. Accurate and significant PIREPS often are not submitted when they are most needed by other aircraft because the pilot is coping with the adverse weather and is too busy to take the time necessary to make a PIREP. In addition, good weather conditions are often not reported, leaving other pilots unaware of areas of improving weather, further contributing to the \$1.7 Billion in delay costs.

At any given time, there are up to 58,000 aircraft airborne. This fleet of aircraft could provide a vast network of airborne weather sensors for the collection and dissemination of accurate real-time three dimensional weather information to other aircraft, Air Traffic Control Centers, and weather forecasting facilities. This network of reporting sites will greatly increase the number of weather collection sites, thus greatly improving weather prediction for all users of weather products.

The National Airspace System is utilized by a wide range of users with different operating needs. Users range from air carriers engaged in domestic and international air transport, to air taxis and commuters, to military pilots flying missions for National Defense, to General Aviation (GA) pilots. These operations involve all phases of flight: departure/climb-out, en-route, oceanic, and approach to landing. As we move to the future with ever increasing demand on the National Airspace System, there is an even greater need to increase system capacity, reduce delays, improve flight efficiency, reduce Air Traffic Controllers workload, and increase safety.

Weather is, and will continue to be, a critical factor in aircraft operations. It is the single largest contributor to delays and a major factor in aircraft accidents and incidents. In 1990, twenty-seven percent (27%) of general aviation and thirty-three percent (33%) of air carrier accidents were weather related. Forty-one percent (41%) of the delay time was weather related, with an associated delay cost of \$1.7 Billion.

A study by Ohio State University for NASA reports that a principle difficulty pilots experience in making good decisions is the timeliness of weather data dissemination. Word of mouth reporting transmitted over congested radio channels is inefficient and sometimes impossible when critical weather is present and a great number of pilots are

working the radio. Obtaining current and accurate weather information is vital for safe flight operations.

Current Services:

The National Weather Service (NWS), along with the National Oceanic and Atmospheric Administration (NOAA), are the primary agencies responsible for collection of weather data in four general categories, namely, surface observations, upper air observations, weather radar, and weather satellite.

Surface and upper air observations:

The NWS operates a wide variety of stations and observation systems to provide weather products. Surface weather conditions are observed and reported at over 1,000 land stations nationwide. Upper air data is generally obtained from rawinsonde balloon soundings taken at 94 NWS locations twice per day. Additional data on both upper air and surface observations are collected via Pilot Reporting (PIREP's) from pilots via the FAA's aviation weather system. These PIREPS may provide information on winds and temperatures aloft, and frequently are the only source of information on aviation hazards such as turbulence and icing.

Weather Radar:

Conventional weather radar observations are taken at 128 National Weather Service locations. Fifty-six of these are network radar sites operated on a continuous basis. The remainder are local warning radar operated as needed to detect potentially severe weather. Radar coverage in the western United States is principally obtained by extracting weather information from the air traffic control (ATC) radar operated by the FAA.

Satellite systems:

Non-Military weather satellite systems are operated by the National Environmental Satellite, Data, and Information Services (NESDIS). The satellites currently provide visible and infrared (IR) images of weather conditions over a major portion of the Western Hemisphere, updated every 30 minutes. Polar satellites provide capability to monitor volcanic ash plumes and weather coverage at high latitudes. In addition, NESDIS also receives and redistributes data from the European and Japanese geosynchronous weather satellites.

Opportunities for Improvements:

The National Weather Service and the Federal Aviation Administration have embarked on a \$4 Billion capitalization program to enhance weather sensors and processors designed to improve national weather services. Considerable progress is expected for collection and dissemination of weather products as new systems come on-line. These systems include Automated Weather Observing System/Automated Surface Observation System (AWOS/ASOS), Next Generation Weather Radar (NEXRAD),

Terminal Doppler Weather Radar (TDWR), and the Geostationary Observational Environmental Satellite (GEOS).

AWOS/ASOS Data Acquisition System (ADAS) will include 537 systems with options for 226 additional stations. ADAS will function primarily as a message concentrator collecting messages from AWOS and ASOS equipment located at controlled and non-controlled airports. ADAS has the ability to distribute up to the minute weather data, so pilots have the data they need in a timely fashion.

With an increased capacity to collect weather products, we must now address the problem of delivery of these products to where they are needed most, in the cockpit. This is the driving need behind WxLink.

User Benefits:

The WxLink system will greatly enhance safety in the cockpit, and decrease costly delays due to non-timely weather reporting. It offers more capability than weather radar or lightning strike detection. Pilots who do not have the onboard equipment will also receive great benefit through Flight Service Stations (FSS) or ATO's enhanced weather awareness.

Considerable expansion has been designed into the WxLink system. As new technologies and sensors emerge, they can be incorporated into WxLink. Two areas of sensor technology that will become available into the WxLink are turbulence detection and ice accretion rate. New modes of data-link can be melded into the architecture of WxLink with ease.

National Weather Service Benefits:

The National Aviation Weather Program Plan (NAWPP) has identified 99 current unmet needs in order to realize a fully capable aviation weather system. WxLink provides possible solutions for 99 of these unmet needs, at no additional cost to government. In addition, other government agencies could now have access to a vast body of real-time weather products as they are transmitted from the airborne platforms. These other agencies include:

Federal Aviation Administration:

The FAA has historically been a provider of aviation weather services rather than a producer. The FAA's principle role has been in the dissemination of products and services to the aviation community. With the implementation of WxLink and the AFR system, the FAA will increasingly become a generator of weather products. This is particularly relevant in the terminal area where time-critical response to short-lived hazards is imperative. Improving direct access to inflight weather will have a significant positive impact on safety and pilot efficiency, reducing the amount

of weather information that ATC had to relay to pilots, thus freeing their time for important tasks of controlling aircraft.

National Aeronautic and Space Administration:

NASA is exclusively an end user of aviation weather information. NASA's aviation activities include Space Shuttle ferry operations, astronaut training flights, testing of prototype aircraft, airborne collection of space, atmospheric, and earth surface data to support scientific research, and routine flights between NASA facilities.

Department of Agriculture:

Aviation activities include wild land fire suppression, insect and disease surveys, animal damage control, law enforcement actions, aerial applications, and sterile insect release. Real time weather condition reporting will increase their ability to perform these functions.

Coast Guard:

The Coast Guard's aviation activities include maritime search and rescue, provisioning of maritime navigation aids, coastal patrol, and drug trafficking interdiction.

Department of Defense (Army, Air Force, Navy, Marines):

The DOD flies thousands of sorties in training, troop transportation, materiel disbursement, and weapons platforms. These missions are flown around the clock in all weather conditions. Enhancing the weather picture enhances the chances for success of these missions, and indeed, provide for a better preparedness in our country's defense.

NOAA:

The National Oceanic and Atmospheric Administration (NOAA) future aviation services include the Forecast Systems Laboratory Aviation Gridded Forecast System (AGFS). The AGFS will provide high resolution, high frequency analysis of weather conditions, including cloud cover, winds, and weather reflectivity. This system depends upon a large number of data samples, which will be provided by the increased number of PIREPs from the WxLink system. The AGFS will support quality improvements for terminal forecast, en-route forecasts, and nowcasts.

National Meteorological Centers:

The addition of thousands of Automatic Pilot Reports will greatly enhance the National Meteorological Centers (NMC) ability to produce numerical grid winds aloft and temperature aloft forecasts.

2. RELATIONSHIP OF THE PARTIES

- 2.1 This MOU is not intended to and does not constitute a joint venture, partnership or other formal business organization. Each PARTY hereto shall not, except as specifically authorized and provided herein, act as an agent for the other PARTY for any purpose whatsoever and no PARTY shall have the authority to bind the other or make any commitment or incur any expenses for or in the name of the other PARTY except to the extent bound herein.
- 2.2 The PARTIES understand and intend, notwithstanding any provisions to the contrary, that this document identifies the current goals of the PARTIES regarding each PARTY's participation in the Program(s) contemplated herein and does not obligate either PARTY to perform any effort hereunder, or enter into any subsequent agreements, except as provided for and agreed upon in the Specific Program Sub-Agreements to this MOU.
- 2.3 If the PARTIES decide to establish a relationship for a specific program, a separate Specific Program Sub-Agreement to this MOU will be negotiated and mutually agreed to utilizing the following guidelines:
- a. Each PARTY is responsible for its own non-recurring development costs to include changes and product improvements and support of its product.
 - b. Each PARTY will support the other in technical briefings to participating aircraft.
 - c. The PARTIES will share technical information as required for systems integration and certification.

3. PROGRAM AMENDMENT PROCESS

- 3.1 When either PARTY identifies a suitable opportunity for a State Program, it will inform the other PARTY of the possible contacts to enact the requirements of the program.
- 3.2 Each PARTY will evaluate the site requirements for Radio Frequency propagation and prepare a summary of the optimum sites for base stations.
- 3.3 Each PARTY will evaluate business and financial requirements for the site and prepare a summary of business arrangements.

- 3.4 If the potential State accepts the site requirements and other business responses of both PARTIES, then the PARTIES will meet in good faith and negotiate a Specific Program Sub-Agreement to this MOU.

4. **TERM AND TERMINATION**

- 4.1 Either PARTY may terminate this MOU upon sixty (60) days prior written notice, provided there are no outstanding proposals or executed Specific Program Sub-Agreements to this MOU.
- 4.2 Once an individual response by either PARTY has been submitted to a customer or potential customer, this MOU can be terminated by either PARTY upon the first to occur of the following:
- a. Final rejection of either PARTY's individual response by the potential State site.
 - b. One (1) year after submittal of an individual response by either PARTY to the potential State site, if no reply to the individual response has been made.
 - c. The potential State site elects to withdraw from the WxLink program.
- 4.3 Neither PARTY may terminate this MOU after a Specific Program Sub-Agreement to it has been executed by the PARTIES, so long as the Specific Program Sub-Agreement remains in force.
- 4.4 Separate Specific Program Sub-Agreements will contain program specific term and termination clauses.

5. **AMENDMENTS**

Amendments to this MOU must be evidenced in writing and executed by a duly authorized representative of each PARTY.

6. **APPLICABLE LAW**

- 6.1 This MOU shall be governed by the laws of the State of Washington in the United States of America.

6.2 The PARTIES shall make every effort to reach an amicable settlement for any dispute arising in connection with this MOU.

7. DISPUTES

Failing settlement, any dispute arising in connection with this MOU shall be settled by arbitration according to the following rules:

The PARTIES agree to submit the dispute for settlement under the rules of conciliation and arbitration of the American Arbitration Association, by an arbitrator to be appointed, at the request of the PARTY seeking arbitration, by the President of the American Arbitration Association. The place of arbitration shall be Seattle, Washington.

8. RIGHT OF LICENSE

No right of license is conveyed or intended to be conveyed by any of the PARTIES to the others by this MOU.

9. LIMITATION OF LIABILITY

IT IS EXPRESSLY AGREED THAT NEITHER PARTY SHALL, IN ANY EVENT BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL, OR OTHER DAMAGES ARISING OUT OF THIS MOU (UP UNTIL EXECUTION OF A SPECIFIC PROGRAM SUB-AGREEMENT HERETO), EVEN IF THE PARTY HAD BEEN ADVISED, KNOWN OR SHOULD HAVE KNOWN OF THE POSSIBILITY THEREOF INCLUDING, BUT NOT LIMITED TO, LOST PROFITS, LOST BUSINESS REVENUES, FAILURE TO REALIZE EXPECTED SAVINGS, OR OTHER COMMERCIAL OR ECONOMIC LOSS OF ANY KIND.

10. PUBLICATION

Announcements, publications or press releases relating to any program referred to in this MOU using the other PARTY's name, may not be made without the unanimous written approval of the PARTIES.

11. SEVERABILITY

The validity of any provision of this MOU shall not affect the validity of its other provisions. Any invalid provision shall be replaced by a valid provision

corresponding as closely as possible to the intentions of the PARTIES as expressed in the invalid provision.

12. **ENTIRE AGREEMENT**

The foregoing articles, amendments, and exhibits hereto contain the entire agreement between the PARTIES and supersede any prior oral or written agreements, commitments, understandings or communications with respect to the subject matter of this MOU.

12.1 This MOU has been signed by the duly authorized representative of each of the PARTIES hereto, as follows.

12.2 Executed in duplicate as of the date last written.

IN WITNESS WHEREOF, the PARTIES hereto have executed this MOU by their duly authorized representatives:

Civil Air Patrol

ARNAV SYSTEMS, INC.

Richard Anderson
(Signature)

Frank P. Williams
(Signature)

(Typed Name)

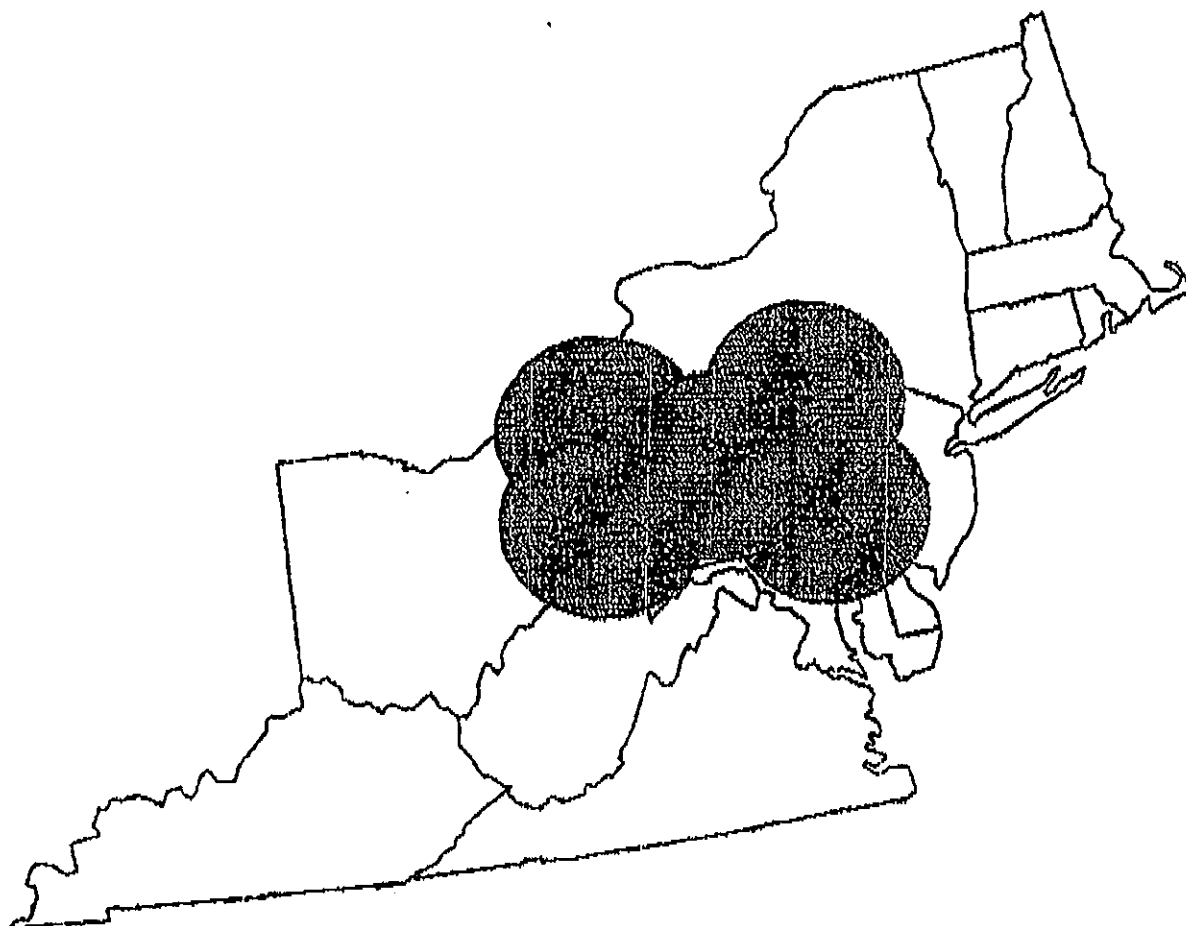
(Typed Name)

(Title)

(Title)

(Date)

(Date)

Program Sub-Agreements for WxLink - Pennsylvania**Pennsylvania WxLink Sites**

AGC	Allegheny	N 40 21.26	W 79 55.80
AVP	Wilkes-Barre	N 41 20.28	W 76 43.45
FKL	Franklin (Chess-Lamberton)	N 41 22.67	W 79 51.62
UNV	State College (University Park)	N 40 50.99	W 77 50.95
40N	Coatesville (Chester County)	N 39 58.73	W 75 51.92

Sites shown provide coverage for entire state from 6000 feet above ground level (AGL).

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SUB AGREEMENT - CIVIL AIR PATROL Inc AND ARNAV Systems Inc.

This sub agreement applies to Civil Air Patrol (CAP) participation in test and evaluation program of with Weather Link (WxLink) system produced by ARNAV. The parties agree that the test period shall be for one year from the time it becomes operational with the understanding that the duration and area of operations may be extended at any time by mutual agreement. To begin the test program:

CAP agrees:

(a) That the CAP Pennsylvania Wing will identify and furnish four CAP aircraft for participation in the program. These aircraft will carry the WxLink equipment in normal CAP operations. Normally, CAP will have no responsibility for submitting technical reports to ARNAV as to the WxLink equipment functioning.

(b) to permit ARNAV to share VHF frequency 149.895 using emission 16K00F2D during the period of the test, such use not interfering with CAP's packet use of the frequency.

ARNAV agrees:

(a) To furnish the four Flight Following Data Link transceivers to CAP in a timely manner. CAP may keep such equipment at the end of the test period and be entitled to updates to WxLink platform software on an ongoing basis.

(b) ARNAV agrees to provide CAP base station software that will display and record in real time, the track, position, and velocity of all aircraft within radio frequency range of base stations. The base station software operates on any 80386 or higher Personal Computer with VGA graphics. The Personal Computer software, along with subsequent update releases, will be supplied at no charge by ARNAV.

(c) To furnish to CAP National Headquarters LG periodic reports on the technical operation and testing results of the WxLink equipment and to use its best efforts to give maximum publicity to CAP's participation in this program.

IN WITNESS WHEREOF THE PARTIES HAVE SET THEIR
HANDS AND SEAL:

CIVIL AIR PATROL INC.

By Richard L. Anderson

RICHARD L. ANDERSON
Brigadier General CAP
National Commander

Date

ARNAV Systems Inc

By Frank Williams

7/31/94
Date



Press Release

For More Information, Call:

Susan Hamner, V.P. Marketing
ARNAV Systems, Inc.
Pierce County Airport
16923 Meridian East
Puyallup, WA 98373
206-848-6060

For Release 3:00 P.M. PST

July 31, 1994

Nationwide DataLink Frequency Goes On-Line

ARNAV Systems, Inc. and the Civil Air Patrol (CAP) have entered into an agreement to provide DataLink services on a nationwide VHF frequency. DataLink provides two way digital communication between the ground to aircraft, and from aircraft to aircraft. The State of Pennsylvania has been chosen as the launch site for DataLink services. The CAP Pennsylvania State Wing will use the DataLink for flight following of their aircraft. The agreement signed by General Richard Anderson, CAP, provides improved Search and Rescue (SAR) coordination, automatic flight following of SAR vehicles, and validation of SAR missions. It also permits rapid deployment and reassignment of en route vehicles. Cockpit WeatherMap displays can be added to show the pilot his position on the search grid and the location of other DataLink equipped vehicles.

As an enhancement to flight safety, the CAP frequency will also be used to uplink real-time weather information to all air traffic. Weather is, and will continue to be, a critical factor in aircraft operations. It is the single largest contributor to delays and is a major factor in aircraft accidents and incidents. In 1990, twenty-seven percent (27%) of general aviation and thirty-three percent (33%) of air carrier accidents were weather related. Forty-one percent (41%) of the delay time was weather related, with an associated delay cost of \$1.7 Billion.

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Working with NASA and the FAA's General Aviation and Vertical Flight Technology Office, ARNAV developed System 6. System 6 is a family of products encompassing Global Positioning System navigation, monitoring and display of aircraft systems, two-way DataLink with flight following and weather dissemination. System 6 promotes the FAA's Situational Awareness of Safety (SAS) concept.

One year after announcing their System 6 technology, ARNAV has initiated DataLink weather services and WeatherMap Multi-Function Displays in Pennsylvania Department of Transportation aircraft. Pennsylvania is the first State where real-time weather information will be uplinked to the cockpit for pilot review. Presented on the WeatherMap Display are hourly sequence reports, up to the minute AWOS data, PIREPS, AIRMETS, SIGMETS, radar summaries, and lightning strikes.

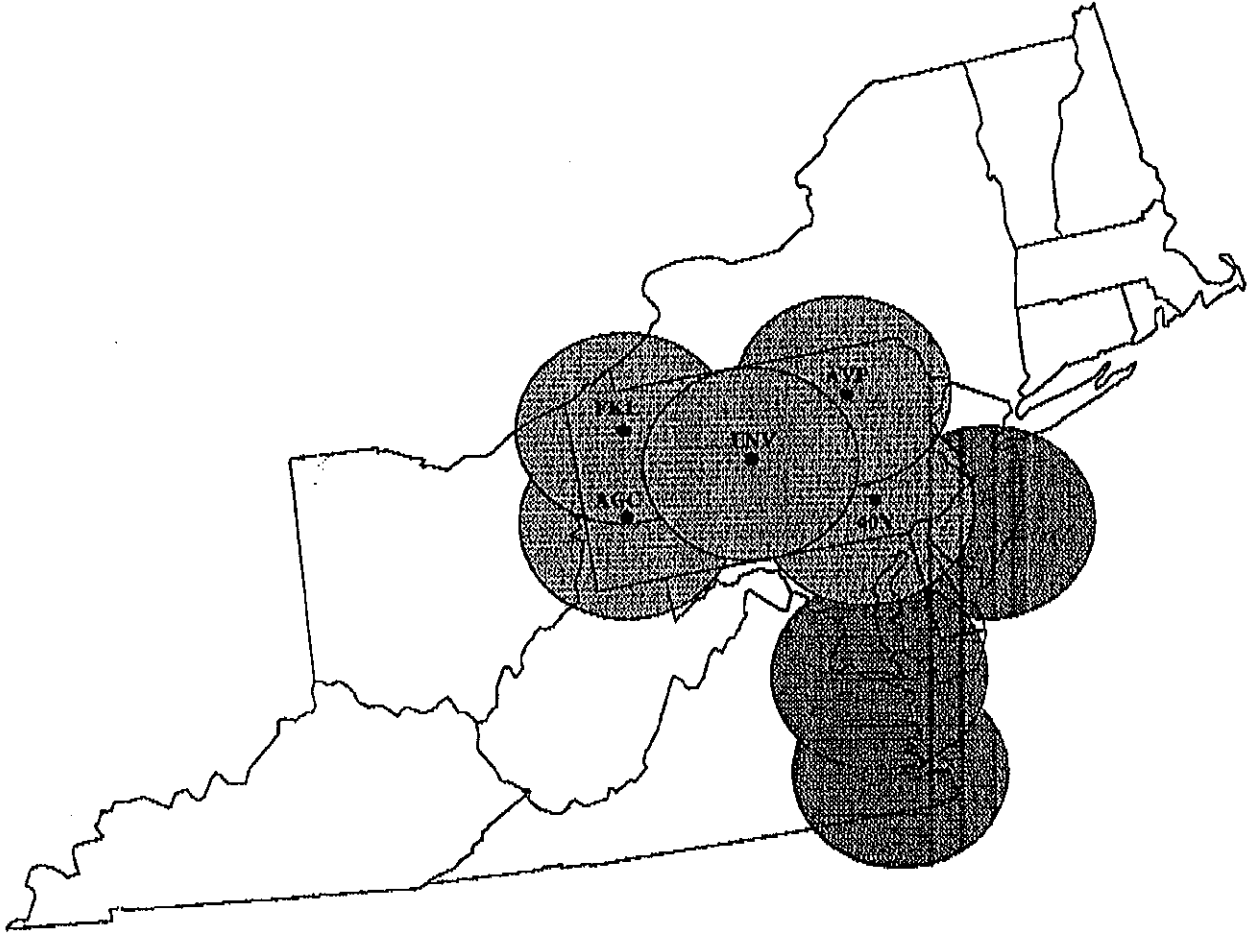
Five DataLink ground transceivers provide statewide coverage. The location of Pennsylvania DataLink ground transceivers are Allegheny, Wilkes-Barre, Franklin, State College, and Coatesville airports.

Sites scheduled for installation in October 1994 are Washington D.C., Atlantic City, and Hampton, Virginia. These additional sites will provide a contiguous corridor in the densely traveled area between southern New York and Southern Virginia. FAA and NASA aircraft will be equipped with DataLink modules to further examine DataLink applications. DataLink sites will be installed nationwide providing continuous weather coverage in the U.S.

Locations of other ARNAV DataLink systems include mainland China, Canada, Washington, Tennessee and Colorado. The Tennessee DataLink site was used for tracking the first GPS approach to a hospital, and will be expanded to provide DataLink coverage for the 1996 Summer Olympics in Atlanta, Georgia. At Denver International Airport, Denver, Colorado, the DataLink performs automated surface movement guidance and control of emergency vehicles and security detection of unauthorized vehicle encroachment into "hot" zones such as active runways. Recently, Honeywell Business and Commercial Aviation and Continental Airlines announced plans to install the ARNAV DataLink onboard Continental aircraft servicing the DIA airport.

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The ARNAV DataLink can integrate VHF, UHF, microwave transmission, and satellite communications to achieve global coverage. Through ARNAV's unique "via-path" technique, VHF transmissions are passed from vehicle to vehicle for up to 1600 hundred miles of service coverage from a single ground transmitter.



Pennsylvania Sites

AGC	Allegheny	N 40 21.26	W 79 55.80
AVP	Wilkes-Barre	N 41 20.28	W 75 43.45
FKL	Franklin (Chess-Lamberton)	N 41 22.67	W 79 51.62
UNV	State College (University Park)	N 40 50.93	W 77 50.95
40N	Coatesville (Chester County)	N 39 58.73	W 75 51.92

ARNAV Systems is a leading manufacturer of Aviation Electronics since 1972. For more information, contact Susan Hamner, VP Marketing.

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Date: 9 August, 1994

TO: SMSgt Kistler
CO: CAP-USAF/MSLM
FX: 205-953-4235

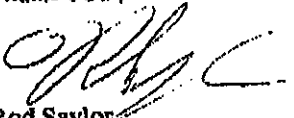
FROM: Rod Saylor
ARNAV SYSTEMS
1 206 848-3555

Pages: 12

MOU

The attached MOU is from Sue Hamner. Please call if you have any questions.

Thank You ,



Rod Saylor
Coordinating Supervisor

Tom Hamner
National Helicopters
CAP
FOY 205 245 4352